

U.S. FISH AND WILDLIFE SERVICE SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

Scientific Name:

Pseudanophthalmus parvus Krekeler

Common Name:

Tatum Cave beetle

Lead region:

Region 4 (Southeast Region)

Information current as of:

08/09/2016

Status/Action

Funding provided for a proposed rule. Assessment not updated.

Species Assessment - determined species did not meet the definition of endangered or threatened under the Endangered Species Act (Act) and, therefore, was not elevated to the Candidate status.

New Candidate

Continuing Candidate

Candidate Removal

Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status

Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species

Range is no longer a U.S. territory

Insufficient information exists on biological vulnerability and threats to support listing

Taxon mistakenly included in past notice of review

- Taxon does not meet the definition of "species"
 Taxon believed to be extinct
 Conservation efforts have removed or reduced threats
 More abundant than believed, diminished threats, or threats eliminated.

Petition Information

Non-Petitioned

Petitioned - Date petition received: 05/11/2004

90-Day Positive: 05/11/2005

12 Month Positive: 05/11/2005

Did the Petition request a reclassification? **No**

For Petitioned Candidate species:

Is the listing warranted (if yes, see summary threats below) **No**

To Date, has publication of the proposal to list been precluded by other higher priority listing? **Yes**

Explanation of why precluded:

Higher priority listing actions, including court-approved settlements, court-ordered and statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, formerly precluded the proposed and final listing rules for this species. We continue to monitor populations and will change its status if necessary. The Progress on Revising the Lists section of the current CNOR (<http://endangered.fws.gov/>) provides information on listing actions taken during the last 12 months.

Historical States/Territories/Countries of Occurrence:

- **States/US Territories:** Kentucky
- **US Counties:** Marion, Kentucky
- **Countries:** United States

Current States/Counties/Territories/Countries of Occurrence:

- **States/US Territories:** Kentucky
- **US Counties:** Marion, Kentucky
- **Countries:** United States

Land Ownership:

The species is known from one privately-owned cave in Marion County, Kentucky.

Lead Region Contact:

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Lead Field Office Contact:

KY ESFO, Michael A. Floyd, 502-695-0468, mike_floyd@fws.gov

Biological Information

Species Description:

Cave beetles in the genus *Pseudanophthalmus* are small, eyeless, reddish-brown insects. Like other adult insects, they have six legs and a body that consists of a head, thorax (second, third, and fourth distinguishable body segments, all of which support one pair of legs), and abdomen. Body length ranges from 3.0 to 8.0 millimeters (mm) (0.12 to 0.32 inches (in)). Species within the genus *Pseudanophthalmus*, which includes approximately 255 described species (Barr 1996, p. 3), are differentiated by differences in the shape and size of the various body parts, especially the shape of the male appendages (genitalia) used during reproduction and the arrangement of setae (hairs) on the body. The Tatum Cave beetle, *P. parvus*, is about 3.5 mm (0.14 in) long and can be distinguished from other

Pseudanophthalmus species by its small size, the serrated (saw-like) margins of its elytra

(modified wings), and the shape of the aedeagus (male copulatory organ) (Krekeler 1973, p. 62).

Taxonomy:

Pseudanophthalmus parvus was described by Krekeler (1973, p. 62) based upon 20 specimens collected in 1957 from Tatum Cave, Marion County, Kentucky. The species belongs to the family Carabidae (ground beetles), subfamily Trechinae, and is one of five species within the *P. inexpectatus* species group in central and south-central Kentucky (Krekeler 1973, p. 62; Barr 2004, pp. 22-23).

Habitat/Life History:

Most members of the genus *Pseudanophthalmus* are cave dependent (trogllobites) and are not found outside the cave environment. All are predatory and feed upon small cave invertebrates such as spiders, mites, millipedes, oligochaete worms, and diplurans; the larger *Pseudanophthalmus* species also feed on cave cricket eggs (Barr 1996, p. 6). Members of this genus vary in rarity from fairly common, widespread species to uncommon, rare species that are restricted to only one or two caves. The Tatum Cave beetle falls within the latter category as it is restricted to one cave in Marion County, Kentucky.

Little detailed life history information is available for the genus *Pseudanophthalmus*, but the generalized summary that follows is accurate for the more common and more easily studied species and is believed to also apply to the rarer species (Barr 1998, p. 3).

Cave beetles copulate in the fall, and the eggs are deposited in cave soil during late fall.

The eggs hatch and larvae appear in late fall through early winter. Pupation occurs in late winter to early summer with the adult beetles emerging in early summer (Barr 1996, p. 5).

The limestone caves in which the genus *Pseudanophthalmus* are found provide a unique and fragile environment that supports a variety of species evolved to survive and reproduce under the demanding conditions found in cave ecosystems. No photosynthesis takes place within the dark zone of a cave. Therefore, all organisms that are adapted to life within a cave are dependent upon energy from the surface to form the basis of the cave food chain. This energy can be in the form of leaf litter, woody debris, small bits of organic matter that are washed or fall into the cave, or guano deposited by cave-dependent bats that feed on the surface and return to the cave to roost (Barr 1996, pp. 6-7).

Pseudanophthalmus beetles tend to be found in moist, humid habitats, and cold, dry influxes of winter air into caves appear to be detrimental to these species, making any collection of the species difficult during the winter months (Lewis and Lewis 2015, p. 2). Although caves of only a few hundred feet in length can support these beetles, larger caves often have structural complexity that supports moist, humid conditions. *Pseudanophthalmus* cave beetles have been found on moist silt banks along streams that run through many of these caves, among gravel, under small boulders, on decomposing wood, and among areas with organic debris (Barr 2001, p. 3).

Historical Range/Distribution:

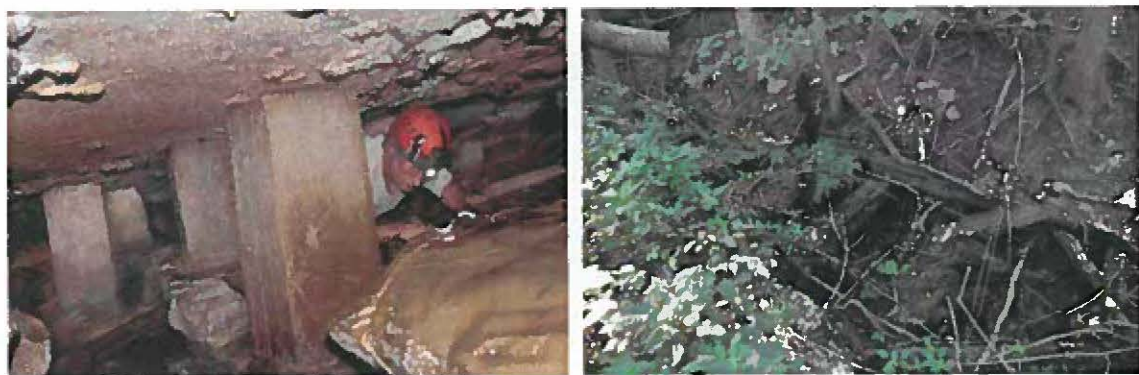
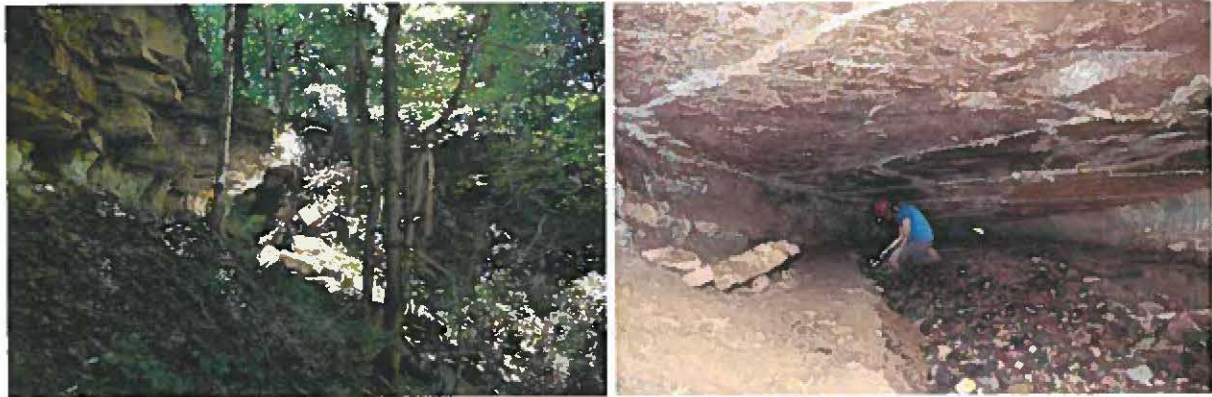
The Tatum Cave beetle's historical distribution consisted of one locality: Tatum Cave in eastern Marion County, Kentucky. The species was discovered in Tatum Cave by C. H.

Krekeler in August 1957, when he collected the type series of 20 specimens (Krekeler 1973, p. 62; Barr 1996, p. 11). Two additional specimens were observed by T. C. Barr in October 1965. Additional visits to Tatum Cave by Barr in July 1980 and by J. J. Lewis in January and June 1996 failed to locate specimens (Barr 1996, p. 11).

Tatum Cave is located approximately 11.2 kilometers (km) (7 miles (mi)) east-southeast of Lebanon in eastern Marion County (Barr 1996, p. 11). According to Barr (1996, p. 11), the cave was named for a former owner, W. G. Tatum.

The cave consists of about 243 meters (m) (800 feet (ft)) of stream passage and has three entrances: an upper sinkhole or pit (created artificially), an intermediate sink with a collapsed roof (also known as a karst window), and a lower stream outlet, which discharges into a ravine at the headwaters of Followell Creek, a tributary of the North Rolling Fork (Salt River drainage) (Figures 1-7) (Barr 1996, p. 11). Between the downstream outlet and intermediate sink, Barr (1996, pp. 11-12) described the cave passage as being about 3 m (10 ft) wide and 2.1 m (6 ft) high. Upstream of the intermediate entrance (karst window), the cave passage gradually becomes smaller, shrinking to 1.5-1.8 m (5-6 ft) high and 0.6-0.9 m (2-3 ft) wide. The upstream pit (or railroad entrance) is an artificial opening created during construction for the Louisville and Nashville Railroad in the 1860s or 1870s (Barr 1996, p. 12; Lewis and Lewis 2016, p. 7). Based on field surveys conducted in 2015 and 2016, Lewis and Lewis (2016, p. 7) concluded that railroad construction likely resulted in the destruction (collapse) of about 91 m (300 ft) of cave passage upstream of the existing railroad entrance. To prevent further collapse, concrete pillars were placed in the cave passage below the railroad entrance and railroad crossties were

used to close the artificial opening. Over time, the cross-ties have deteriorated, allowing water to seep back into the cave and reopen the artificial entrance. Upstream of this artificial opening, the cave passage narrows and quickly becomes impassable to humans.



Figures 1-7. Tatum Cave: 1, Spring (downstream) opening in ravine (top row, left); 2, cave passage just upstream of spring opening (top row, right); 3, intermediate opening (karst window) (middle row, left); 4, cave passage just upstream of intermediate opening and location of species' discovery in 1957 (middle row, center); 5, cave passage approaching upstream sink (middle row, right); 6, narrow crawlway and concrete pillars near railroad entrance (bottom row, left); and 7, upstream sink or railroad entrance (bottom row, right) (photographs provided by Lewis and Associates, LLC).

Current Range/Distribution:

The Tatum Cave beetle's current range consists of one cave (Tatum Cave), but the species has not been observed there since 1965. Subsequent surveys of Tatum Cave by T. C. Barr in 1980, J. J. Lewis in 1996, E. Laudermilk in 2004 (two visits) and 2005 (one visit), J. J. Lewis and S. L. Lewis in July and August 2015 (three visits) and May 2016 (two visits) failed to produce additional records of the species (Table 1) (Lewis and Lewis 2015, pp. 20-24; Lewis and Lewis 2016, entire).

Table 1. Summary of Tatum Cave beetle (*P. parvus*) surveys and observations in Tatum Cave, Marion County, Kentucky.

Collector	# <i>P. parvus</i> observed	Date	Reference
C. H. Krekeler	20	August 17, 1957	Krekeler (1973)
T. C. Barr	2	October 9, 1965	Krekeler (1973)
T. C. Barr	0	July 1980*	Barr (1996)
J. J. Lewis	0	January 1996*	Barr (1996)
J. J. Lewis	0	July 1996*	Barr (1996)
E. L. Laudermilk	0	October 4, 2004	Laudermilk (2006)
E. L. Laudermilk	0	October 11, 2004**	Laudermilk (2006)
E. L. Laudermilk	0	September 29, 2005	Laudermilk (2006)
J. J. Lewis, S. L. Lewis	0	July 31, 2015	Lewis and Lewis (2015)
J. J. Lewis, S. L. Lewis	0	August 16, 2015**	Lewis and Lewis (2015)
J. J. Lewis, S. L. Lewis	0	May 14, 2016	Lewis and Lewis (2016)
J. J. Lewis, S. L. Lewis	0	May 21, 2016**	Lewis and Lewis (2016)

*Specific collection date unavailable; **Surveys also included pitfall trapping.

Population Estimates/Status:

Population estimates are unavailable for *P. parvus* as the species has not been observed in Tatum Cave since 1965. As shown in Table 1 above, the species was relatively abundant (20 individuals) in Tatum Cave when first observed by C. H. Krekeler in 1957 (Lewis and Lewis 2016, p. 6), but the species appeared to be less common in 1965 when T. C. Barr observed only two individuals. Based on their familiarity with search methods used by Barr, Lewis and Lewis (2016, p. 6) explained that Barr would have searched all available habitats in Tatum Cave by slowly crawling through the cave, turning over rocks and visually inspecting the floor and walls. If additional specimens of *P. parvus* had been observed, Barr would have reported them.

Since 1965, extensive surveys of Tatum Cave have been completed on eight separate occasions, using search techniques similar to those used by C. H. Krekeler and T. C. Barr (i.e., methodical visual searches of all available habitats) (Lewis and Lewis 2015, pp. 20-24; Lewis and Lewis 2016, entire). Three of these survey efforts also involved the use of baited pitfall traps (small cups buried in the substrate and baited with limburger cheese) placed in several locations within Tatum Cave for a period of one week. Despite all of these searches, no Tatum Cave beetles have been observed in Tatum Cave since the last observation by Barr in 1965 (Table 1).

Extinction:

The Tatum Cave beetle is small in size and may be more difficult to locate than some cave organisms; however, both Krekeler and Barr were able to find the species using methodical, visual searches of suitable habitats in Tatum Cave. Subsequent researchers have

used identical search methods on eight separate occasions in the exact same habitats within Tatum Cave, but no Tatum Cave beetles have been observed for over 50 years. Therefore, based on the best available scientific and commercial information, the Service believes the Tatum Cave beetle to be extinct.

We acknowledge that it is difficult, if not impossible, to verify a species' extinction. There is considerable uncertainty about the actual status of the species, and we acknowledge that, as suggested by Lewis and Lewis (2015, pp. 32-33), there is some chance that the species remains extant, but occurs in low numbers and is simply undetectable using traditional search methods. However, considering the best available scientific and commercial information, we believe that it is reasonable to conclude that the species is extinct.

We do not know why the Tatum Cave beetle has declined to the point that we presume it to be extinct. Tatum Cave appears to provide the necessary habitat requirements to support the species, and the presence of other ground beetles (Family Carabidae) and cave invertebrates support this assessment. It is possible that the collapse of the upstream passage and the creation of the artificial railroad entrance have altered habitat conditions within Tatum Cave and contributed to the species' decline.

Threats

Based on the best available scientific and commercial information, we believe the Tatum Cave beetle to be extinct, and, therefore, we have not analyzed the five listing factors under the Act (threats) in this assessment form. Under the Act, analysis of the listing factors are pertinent

only in cases where the organism being evaluated for listing is a listable entity. Since we believe the species is extinct, it is no longer a listable entity.

Foreseeable Future

Based on the best available scientific and commercial information, we believe the Tatum Cave beetle to be extinct and therefore there is no need to address foreseeable future.

Finding:

Section 4 of the Act, and its implementing regulations at 50 CFR part 424, set forth the procedures for adding species to the Federal Lists of Endangered and Threatened Wildlife and Plants. Under section 4(b)(1)(a), the Secretary is to make endangered or threatened determinations required by subsection 4(a)(1) solely on the basis of the best scientific and commercial data available to her after conducting a review of the status of the species and after taking into account conservation efforts by States or foreign nations. The standards for determining whether a species is an endangered species or a threatened species are provided in section 3 of the Act. An endangered species is any species that is “in danger of extinction throughout all or a significant portion of its range.” A threatened species is any species that is “likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.” Per section 4(a)(1) of the Act, we determine whether any species meets the definition of an endangered species or a threatened species because of any of the following five factors: (A) the present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational

purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; and (E) other natural or manmade factors affecting its continued existence.

A species cannot be eligible for listing under the Act if it is already extinct. Although the Act does not directly address the situation of considering a species for listing that we believe is already extinct, the purpose of the Act is to prevent species from becoming extinct. If we believe the species is already extinct, by definition, the species would not be in danger of extinction or likely to become so in the foreseeable future, and, also, there would be no benefit to proposing protections under the Act. In addition, our regulations at 50 CFR 424.11(d) codify the reasons to remove from the list species that are designated as threatened species or endangered species; one of these reasons is extinction. Therefore, if extinction is a valid basis to delist a species, it would be an equally valid basis to decline to list it. For a species to be delisted due to extinction, a sufficient period of time must have elapsed since its last observation (50 CFR 424.11(d)(1)). We consider 51 years to be a sufficient period of time for the Tatum Cave beetle based on the species' one-year life cycle and the number of intensive searches in known and suitable habitats that have been completed within Tatum Cave over that time period. This species and other *Pseudanophthalmus* are small and sometimes difficult to find; however, both Krekeler and Barr were able to find *P. parvus* using methodical, visual searches of suitable habitats in Tatum Cave. Subsequent researchers have used identical search methods on eight separate occasions in the exact same habitats within Tatum Cave, but no Tatum Cave beetles have been observed. The most recent surveys in 2015 and 2016 (Lewis and Lewis 2015, pp. 20-24; 2016, entire) involved intensive visual searches of previously occupied habitats and placement of baited pitfall traps. Despite all of these efforts, we have been unable to confirm the existence of the species in more

than 51 years.

Therefore, the best available scientific and commercial information leads us to believe that the Tatum Cave beetle is extinct, and, as such, it is not eligible for listing as an endangered species or a threatened species under the Act. Therefore, we did not further evaluate whether the Tatum Cave beetle is in danger of extinction throughout its range (an endangered species), likely to become in danger of extinction throughout its range in the foreseeable future (a threatened species), or whether the species is an endangered or threatened species in a significant portion of its range.

Significant Portion of the Range

Based on the best available scientific and commercial information, we believe the Tatum Cave beetle to be extinct and therefore the SPR policy does not apply.

For species that are being removed from candidate status:

No Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions (PECE)?

Recommended Conservation Measures:

Recommended conservation measures include the following:

- Maintain landowner contacts and continue to search for the species;
- Prepare a cave map of Tatum Cave;
- Conduct additional pitfall trapping in the concrete pillar passage;

- Close the artificial entrance;
- Remove creosote-treated crossties; and
- Search for additional populations in Marion County.

Emergency Listing Review: Is Emergency Listing Warranted?

Emergency listing is not warranted. Based on detailed review of the best available scientific and commercial information, we have determined that this species is extinct and, therefore, is ineligible for listing under the Act.

Description of Monitoring:

The Service encourages continued surveys for the Tatum Cave beetle in Tatum Cave, as time and funding allows. If the species is subsequently found to be extant, we can reevaluate its legal status under the Act in the future.

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment:

None

Indicate which State(s) did not provide any information or comment:

Kentucky

State Coordination:

In the mid-1990s, the Kentucky Department of Fish and Wildlife Resources (KDFWR), in

cooperation with the Service, funded a status survey for the rarer *Pseudanophthalmus* beetles that occur in Kentucky (Barr 1996, entire). These efforts included surveys of Tatum Cave. Service funds supported a second state-wide beetle survey by the Kentucky State Nature Preserves Commission (KSNPC) in the mid-2000s (Laudermilk 2006, entire). Kentucky has not included insects in its Wildlife Action Plan (KDFWR 2013); the only invertebrates included in the plan have been freshwater mussels and crayfishes.

Literature Cited:

- Barr, T. C., 1996. Cave beetle status survey and prelisting recovery project. Unpublished report to Kentucky Department of Fish and Wildlife Resources, Frankfort, Kentucky, and the U.S. Fish and Wildlife Service, Asheville, North Carolina. 63 pp.
- Barr, T. C. 1998. Study of potentially threatened or endangered species of cave beetles in Tennessee, Alabama, and Georgia. Interim progress report to the Tennessee Wildlife Resources Commission. 11 pp.
- Barr, T.C. 2001. Cave beetles in Tennessee, Alabama, and Georgia, potentially threatened or endangered species of *Pseudanophthalmus* (Coleoptera: Carabidae). Final report to U.S. Department of Interior, Office of Endangered Species and Tennessee Wildlife Resources Agency. 36 pp.
- Barr, Thomas C. 2004. A classification and checklist of the genus *Pseudanophthalmus* Jeannel (Coleoptera: Carabidae: Trechinae). Virginia Museum of Natural History Special Publication 11. 52 pp.
- Kentucky Department of Fish and Wildlife Resources (KDFWR). 2013. Kentucky's Comprehensive Wildlife Conservation Strategy. KDFWR, Frankfort, Kentucky. Available from: <http://fw.ky.gov/WAP/Pages/Default.aspx> (Date updated 2/5/2013).
- Krekeler, C. H. 1973. Cave beetles of the Genus *Pseudanophthalmus* (Coleoptera: Carabidae) from the Kentucky Bluegrass and vicinity. *Fieldiana* 62(4):35-83.
- Laudermilk, Ellis L. 2006. A survey for Kentucky *Pseudanophthalmus* (Coleoptera: Carabidae: Trichinae) species considered candidates for listing by the U. S. Fish and Wildlife Service. Kentucky State Nature Preserves Commission, Frankfort, Kentucky. 15 pp.
- Lewis, J. J. 2016. Tatum Cave beetle (*Pseudanophthalmus parvus*) draft report. Unpublished technical report submitted to U.S. Fish and Wildlife Service, Frankfort, Kentucky. 12 pp.
- Lewis, J. J. and S. L. Lewis. 2015. Pre-listing evaluation of populations and habitats of four

species of Kentucky cave beetles (*Pseudanophthalmus*). Unpublished technical report submitted to U.S. Fish and Wildlife Service, Frankfort, Kentucky. 38 pp.

Approval/Concurrence:

Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve: Mike O'Leary 8-16-16
Acting Regional Director Date

Concur: Steph Gunt 9/20/16
Acting Director Date

Did not concur: _____
Date

Director's Remarks: